But none of the stars visible upon the nebula show diffused or ill-defined borders; so that they are probably neither in the nebula nor behind it, but before it, and forming part of the Milky Way. And as the two new stars alluded to are also well and clearly defined, he argues that they also are connected with the Milky Way, and not with the nebula, which he regards as lying behind it.

THE NICE OBSERVATORY.—The great objective of 30 inches diameter, intended for the Nice Observatory, and the glass for which was supplied by M. Feil, has just been completed by the Brothers Henry, and has been placed in the hands of M. Gautier, who is constructing the equatorial, which he hopes to finish by April next.

ASTRONOMICAL PHENOMENA FOR THE WEEK, 1885, *NOVEMBER* 29 *TO DECEMBER* 5

(FOR the reckoning of time the civil day, commencing at Greenwich mean midnight, counting the hours on to 24, is here employed.)

At Greenwich on November 29

Sun rises, 7h. 43m.; souths, 11h. 48m. 35·7s.; sets, 15h. 54m.; decl. on meridian, 21° 34′ S.: Sidereal Time at Sunset, 20h. 29m.

Moon (at Last Quarter) rises, 23h. 16m.*; souths, 6h. 9m.; sets, 12h. 49m.; decl. on meridian, 6° 58′ N.

Planet	Rises h. m.		Souths h. m.		Sets h. m.		Decl. on meridian ° ′
Mercury ...	9 45	...	13 20	...	16 55	...	25 47 S.
Venus ...	11 25	...	15 14	...	19 3	...	23 56 S.
Mars ...	23 22*	...	6 16	...	13 10	...	9 49 N.
Jupiter ...	1 31	...	7 36	...	13 41	...	0 16 N.
Saturn ...	17 49*	...	1 58	...	10 7	...	22 23 N.

* Indicates that the rising is that of the preceding day.

Occultations of Planet and Star by the Moon

Dec.	Star	Mag.	Disap. h. m.	Reap. h. m.	Corresponding angles from vertex to right for inverted image ° °
1 ...	Uranus	— ...	5 0 ...	6 9 ...	53 213
3 ...	κ Virginis... ...	4½ ...	4 24 ...	4 56 ...	92 155

Phenomena of Jupiter's Satellites

Nov.		h. m.		Dec.		h. m.	
29	...	3 23	I. tr. ing.	3	...	1 53	II. ecl. disap.
29	...	5 39	I. tr. egr.	3	...	7 0	II. occ. reap.
30	...	3 0	I. occ. reap.	4	...	5 9	III. tr. ing.
				5	...	2 8	II. tr. egr.
				5	...	7 3	I. ecl. disap.

The Occultations of Stars and Phenomena of Jupiter's Satellites are such as are visible at Greenwich.

Nov.		h.		
29	...	9	...	Mars in conjunction with and 3° 23′ north of the Moon.
30	...	23	...	Jupiter in conjunction with and 0° 20′ north of the Moon.
Dec.				
1	...	0	...	Mercury at greatest elongation from the Sun, 21° east.

Variable Stars

Star	R.A. h. m. s.		Decl. ° ′		Epoch	h. m.		Phase
U Cephei.	0 52 8	...	81 15·3 N.	...	Nov. 29,	3 27	...	*m*
					Dec. 4,	3 7	...	*m*
Algol ...	3 0 41	...	40 30·7 N.	...	Nov. 29,	5 20	...	*m*
					Dec. 2,	2 9	...	*m*
					,, 4,	22 58	...	*m*
λ Tauri ...	3 54 19	...	12 9·9 N.	...	Dec. 1,	20 9	...	*m*
					,, 5,	19 1	...	*m*
η Aquilæ..	19 46 37	...	0 42·7 N.	...	Nov. 30,	2 30	...	*M*
					Dec. 4,	21 30	...	*m*
δ Cephei..	22 24 54	...	57 49·6 N.	...	Nov. 30,	1 0	...	*m*

M signifies maximum; *m* minimum.

The spectrum of R Andromedæ R.A. 0h. 17m. 58s., Decl. 37° 56′·4 N. deserves attention. The star is now approaching its maximum.

The following circular has been sent out from Lord Crawford's Observatory, Dun Echt:—"Considering the great uncertainty which envelopes the fate of Biela's comet, it seems desirable to call to mind that about midnight on the 27th inst. the earth will be in the path of the meteors seen to radiate from near γ Andromedæ on November 27, 1872. The comet's periodic time, and presumably that of the meteors being about 6·6 years, nearly two periods will have elapsed since the meteoric shower of 1872. If, therefore, the meteors are very widely distributed along the comet's orbit, there is a chance that they may again appear in considerable numbers this year. In 1892, and still more in 1905, there is a probability of a return of the display of 1872.

GEOGRAPHICAL NOTES

LIEUT. GREELY has been lecturing in Scotland on the Arctic Expedition of which he was the commander. At Dundee, on Monday night, having described the retreat from Discovery Harbour, Lady Franklin Bay, he went on to speak of the results of the Expedition, which could be done only in a general manner. The temperature observations, he remarked, were mainly important in determining the fact that Grinnell Land had the lowest mean temperature in the globe, about 4° F., or 20° C. below zero. This was in accordance with their expectations. The tidal observations, only roughly reduced by him at Conger, confirmed the work of 1875-76, but a large number of simultaneous readings at seven special stations in the Polar Sea, Robeson and Kennedy Channels, should enable tidal experts to determine quite accurately the shape and direction of the tidal wave, an important element in the theoretical determination of the configuration of lands and sea-bottom to the north. In Grinnell Land the discovery of coal not only at various points along the sea-coast, but at others in the interior, proved conclusively the changed climatic condition, as did the fossil forest found near Cape Baird in 81° 30′ N. Discoveries of Eskimo remains were of interest as showing the possible extent of this immigration of a new race into the Polar Basin. The Lieutenant next spoke of geographical discoveries. The furthest point seen by Beaumont was Cape Britannia, nearly 50 miles beyond the extreme point actually attained by that heroic officer. From Britannia Island Lieut. Lockwood and Sergeant Brainard pushed on 100 miles further, and passed a day and a half at Lockwood Island, the furthest point by land or sea ever attained by civilised man, in 83° 24′ N., 40° 46′ W. From an elevation of nearly 3000 feet it was evident that no land existed within a radius of sixty miles to the north or north-westward, but to the north-east the Greenland coast yet trended, ending to the eye at Cape Washington in 83° 35′ N. To Greenland was thus added 125 miles of new coast excluding the fiord lines, and from Cape May the mainland was carried a degree of latitude to the northward. In carrying Greenland 10° of longitude further to the eastward, Lieut. Lockwood left but 16° for his successors to fill in. The new land is composed of high precipitous promontories along the coast, and equally broken country inland, in which but three glaciers were seen, none discharging. It was evident that the inland ice-cap of Greenland stopped far to the southward of the 82nd parallel. In short, there existed from Robeson and Kennedy Channels, westward to Greely Fiord and the Polar Sea, a series of fertile valleys clothed with vegetation of luxuriant growth, whereon were large herds of musk oxen. He desired to say a few words as to his discoveries concerning the much-talked-of palæocrystic ice, especially the floebergs from 100 to 1000 feet thick. The opinion advanced by Sir G. Nares that this ice formed over the Arctic Ocean was not borne out by facts, and he could not commit himself to the judgment that this sea was for ever unnavigable, for they knew that a quantity of the ice changed from year to year, and little of it was seen by Lieut. Lockwood to the northward of Cape May. Dr. Moss was certainly correct as to the universality of stratification in this ancient ice, and he concurred in the opinion that its salinity was due to efflorescence and infiltration. There was no doubt in his mind that these floes were simply detachments of slowly-moving glacial ice-caps from an ice-covered land in the neighbourhood of the Pole. Lieut. Lockwood found small floebergs, perhaps 100 to 200 feet thick, detached from the adjacent ice-caps. In Kane Sea he visited a floeberg a third of a mile wide, a quarter of a mile long, and from a fifth to a sixth of a mile thick. The proof as to its terrestrial origin no one would dispute; on its surface were two valleys about 30 feet deep, along which were the medial moraines of the glacier—fully 100 large stones polished and worn smooth in places by the parent ice. He thought it doubtful

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whether such an ice-cap increased by more than three or four inches yearly, so that from 3000 to 4000 years might easily have elapsed since the incipient birth of the berg in question. Lieut. Greely advocated future Arctic exploration in the direction of Franz Josef Land.

MR. GAMEL, at whose sole expense the late expedition to the Kara Sea, under Lieut. Hovgaard, was undertaken, intends, provided his enterprise be seconded by the Government, to send his steamer *Dijmphna* next summer on an expedition, under an officer of the Danish Royal Navy, to the east coast of Greenland, to explore and lay down the coast-line between 66°·08, the farthest northward point attained by Capt. Holms's expedition, and 70°.

ACCORDING to the *Gazette Géographique*, M. Moller, who was recently charged with a mission of botanical investigation to the Island of St. Thomas, has returned to Lisbon. He has brought with him a large number of interesting specimens, not only of the botany, but also of the geology, of the island. These have been placed for investigation in the hands of M. Henriques, the Professor of Botany of the Coimbra University. M. Moller has also made some important additions to and corrections in the map of St. Thomas recently published. He has proved that the highest mountain in the island is the Peak of St. Thomas, and that its height is 2142 metres.

AN officer of the French Navy, Commander Réveillère, has succeeded in a daring attempt which he made recently to ascend the rapids of the Meikong, beyond Samboc, in a steamer. Samboc is the chief Cambodian town on the river, and at one time it was thought impossible for a steamer even to reach that point. A short distance above the town commences a series of rapids, which last for about forty miles, and which in parts appear as formidable obstacles to navigation as the cataracts on the Nile. Commander Réveillère, however, succeeded in overcoming them, but only after such exertion and danger as make it clear that in their present state they present an insuperable barrier to navigation for commercial purposes. He proposes a thorough hydrographic study of this section of the river at low water, and he is convinced that the famous barrier will turn out to be merely a mass of trees which has got permanently fixed there and is maintained by annual additions, but which can be removed without difficulty by means of explosives. Beyond the rapids is the town of Stung-Treng, where the greater part of the commerce of the Laos reaches the river, and hence the advantage of a navigable passage. Commander Réveillère concludes his account of his feat by recommending "a serious hydrographic campaign in the rapids of the Meikong, and in the lower Laos." The Meikong is one of the greatest of the great rivers of Asia; it was first thoroughly explored fifteen years ago by a mission under Lagrée and Garnier, which came to the conclusion that this magnificent water-way was useless for trade purposes on account of its rapids.

LIEUT. ALLEN has lately returned to San Francisco from a successful exploration of Alaska, undertaken by direction of the United States Government. He left Sitka in February, going to the mouth of the Copper River, which he ascended as far as the great mountain range of Alaska. He crossed the mountains with snow-shoes, coming to the sources of the Tennah, which river he followed for 800 miles to its junction with the Takon, and he descended this latter river to its mouth, a journey of between 400 and 500 miles. From the mouth of the Takon he went to Fort Michael, on Behring's Straits, whence he came home.

THE proposal that the Netherlands Government should make a grant to the Dutch Geographical Society towards the expenses of the projected scientific expedition for the exploration of the half of New Guinea belonging to Holland has been rejected by the Second Chamber by a large majority, there being forty-nine votes against the motion to twenty-one in favour of it. In the debate most of the speakers expressed their conviction of the desirability of the expedition maintaining the character of a purely private enterprise.

A NEW edition of Dr. Hunter's "Indian Gazetteer of India" in twelve volumes is in the press. Several of the volumes will be published in the course of the next few weeks.

THE November number of the Austrian *Monatsschrift für den Orient* contains a long communication from Dr. Lenz, from Ango-Ango, with reference to his expedition to the Congo. It deals mainly with the superficial aspects of the various settlements on the West Coast of Africa, of the trade there and its future prospects, and especially with the prospects of Austrian trade.

UNDER the title, "La Corée avant les Traités," M. Jametel, a French writer on the Far East, has published, in a *brochure* of about eighty pages, four articles which he contributed to recent numbers of *La Revue de Géographie*. He describes the voyage from Nagasaki to Fusan, a Corean port then only opened to Japanese trade, and gives a sketch of the history of the peninsula from early times; finally he describes the Japanese settlement at Fusan and the neighbouring Corean town of Toraifu, and adds a few words about the Island of Quelpaest. The account is very lively and amusing, but it can hardly be said to add much to our geographical knowledge of Corea, small as that was before the treaties.

CHLOROPHYLL[1]

ALL who are accustomed to observe vegetation must have been struck with the great variety of shades of green which the foliage of different plants presents. Without pretending to generalise further, it may be stated that, at any rate so far as our common agricultural plants are concerned, they show somewhat characteristic shades of colour, according to the *Natural Order* to which they belong—the Leguminosæ differing from the Gramineæ, the Cruciferæ, the Chenopodiaceæ, and so on. But the same description of plant will exhibit very characteristic differences, not only at different stages of growth, but at the same stage in different conditions of luxuriance, as affected by the external conditions of soil, season, manuring, &c., but especially under the influence of different conditions as to manuring.

The Rothamsted field experiments have afforded ample opportunity for observations of this kind; and it has been quite evident that, in a series of comparable experiments with the same crop, depth of green colour by no means necessarily implied a finally greater amount of carbon assimilation; whilst we have long ago experimentally proved that the deeper colour was associated with relatively high percentage of nitrogen in the dry or solid substance of the herbage; and this obviously means a lower relation of carbon to nitrogen.

Mentioning these facts to Dr. W. J. Russell, who has devoted so much attention to the subject of chlorophyll, he kindly undertook to make comparative determinations of the amounts of chlorophyll in parallel specimens, in which we were to determine the percentages of dry matter and of nitrogen. Accordingly in June, 1882, during the period of active vegation, Dr. Russell spent a day at Rothamsted for the purpose of collecting appropriate samples, which were taken from several differently-manured plots of meadow-grass, wheat, barley, and potatoes, respectively.

The following table gives the results of some of these experiments; namely, the percentages of nitrogen, and the relative amounts of chlorophyll, in the separated gramineous and the separated leguminous plants in the mixed herbage of grass-land; in specimens of wheat grown by a purely nitrogenous manure, and by the same nitrogenous manure with a full mineral manure in addition; and in specimens of barley grown by a purely nitrogenous manure, and by a mixture of the same nitrogenous manure and mineral manure in addition. It is to be borne in mind that the specimens were collected while the plants were still quite green and actively growing. It should be further explained that the amounts of chlorophyll recorded are, as stated in the table, relative and not actual; that is to say, the figures show the relative amounts for the individual members of each pair of experiments, and not the comparative amounts as between one set of experiments and another.

It will be seen in the first place that the separated leguminous herbage of hay contained a much higher percentage of nitrogen in its dry substance than the separated gramineous herbage; and that, with the much higher percentage of nitrogen in the leguminous herbage, there was also a much higher proportion of chlorophyll. Under comparable conditions, however, the Leguminosæ eventually maintain a much higher relation of nitrogen to carbon than the Gramineæ; in other words, in their

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[1] "Note on some Conditions of the Development, and of the Activity, of Chlorophyll." By Prof. J. H. Gilbert, LL.D., F.R.S. Read in Section B at the meeting of the British Association at Aberdeen, September, 1885. (Abstract.)

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